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Field Study

Demographic and occupational determinants of the work ability of firemen

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Abstract: Objectives: Firefighters tackle various stressors that affect their health and job performance; therefore, assessment of their work ability is necessary. This study aimed to investigate the demographic and occupational determinants of the work ability of firemen. **Methods:** In this cross-sectional study, 375 firemen working in Tehran Fire Department were randomly selected. Demographic, occupational, and work ability index (WAI) questionnaires were applied as research tools. **Results:** The mean firemen's WAI score was relatively high. There were significant relationships between WAI and age, body mass index, work experience, and weekly leisure-time physical exercise hours. Single employees, those who did not have extra jobs and did not smoke, had greater scores compared to their counterparts. Poisson regression revealed that age and weekly leisure-time physical exercise hours could affect WAI significantly. **Conclusions:** Although Iranian firemen revealed good work ability, recognizing factors affecting this ability and preparing facilities to promote their function is necessary.
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Key words: Demographic variables, Firemen, Work ability index (WAI)

Introduction

The importance of identifying workers' physical and mental capabilities as the fundamental of achieving safer recruitments, preserving workforce health, and enhancing job productivity is undeniable[1-3]. In spite of today's technological achievements, the need for employing humans in several strenuous jobs including firefighting is still essential. Firefighting is ranked as the fifth most perilous occupation in North America with an overall job mortality rate of 48.8 deaths per 100,000 workers[4]. Although most people presume that firefighters are just responsible for suppressing fires, they also have to deal with several other tasks related to safety and emergency relief operations. Besides encountering a variety of physical and chemical hazardous factors, dealing with littered and unfamiliar work environments, tragic events, stressful job duties, and shift working are the other examples of their arduous job characteristics[4]. Several studies emphasized the fact that the stressors related to emergency jobs affect workers' physical and mental health, quality of life, and performance[4,5]. Hence, assessment of work ability in these workers in view of the importance of their job is crucially momentous.

As no comprehensive and feasible methods were available in order to assess the work ability with epidemiological studies, in 1981, researchers at Finnish Institute of Occupational Health (FIOH) constructed the work ability index (WAI) based on the concepts of worker's health, their physical and mental competences, and the nature of their job[6,7]. Since then, WAI is being used as an appropriate international instrument in order to estimate workers' overall capabilities and to determine its associates[8]. Eskelinen et al. found that WAI correlates well with the clinical assessments of workers' abilities[9]. In several previous studies, the relationships between WAI and numerous demographic and occupational factors including age[8,10-15], BMI (body mass index)[12,15-17], education[8,13,16], physical activity[14,15,18,19], life style[15], job requirements and characteristics[8,15,20,21], work's physical demands[22-26], ergonomic inappropriate factors such as awkward or static postures and repetitive movements[14], musculoskeletal and psychosomatic symptoms[13], psychosocial factors[14,17,23], job tenure[8], mental workload[15], and social support[8,14] have been indicated.

Considering the lack of previous studies on fire-

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Table 1. Work Ability Index (WAI) and its categories

Item	Scale	Explanation
Subjective estimation of present work ability compared with the lifetime best	1-10	0=very poor 10=very good
Subjective work ability in relation to both physical and mental demands of the work	2-10	2=very poor 10=very good
Number of diagnosed diseases	1-7	1=5 or more diseases 2=4 diseases 3=3 diseases 4=2 diseases 5=1 disease 7=no disease
Subjective estimation of work impairment due to disease	1-6	1=fully impaired 6=no impairment
Sickness absence during past year	1-5	1=100 days or more 2=25-99 days 3=10-24 days 4=1-9 days 5=0 day
Own prognosis of work ability during two years from now	1, 4, 7	1=hardly able to work 4=not sure 7=fairly sure
Psychological resources (enjoying daily tasks, activity and life spirit, optimistic about the future)	1-4	1=very poor 4=very good

fighters' work ability, especially in Iran, this study was conducted with the aim of investigating this ability as well as its determinants among them, so that the achieved results could assist in making policies to enhance firemen's work ability and their efficiency.

Subjects and Methods

In this cross-sectional study 375 out of 5000 firemen working in the suppression division of Tehran Fire Department were randomly selected in 2014. They were divided into five job positions namely station managers, shift commanders, commander assistants, senior firefighters, and firefighters. After explaining the purpose of the study to the participants and emphasizing the confidentiality of their identity, an informed consent document was signed and demographic and occupational questionnaire (including questions on age, height, education level, marital status, smoking habits, job position, work experience in suppression division, number of weekly working hours, extra jobs, and leisure-time and physical exercise time per week) as well as WAI were filled in[27].

According to Table 1, WAI was derived as the sum of the scores of seven items (ranging from 7 to 49), and subsequently divided into the following four categories: poor work ability (scores 7-27), moderate work ability (scores 28-36), good work ability (scores 37-43), and excellent work ability (scores 44-49) (Table 1)[11].

This index has been applied in several previous studies in Iran and had acceptable reliability and validity among the Iranian working population[8,11,28]. In this study WAI was translated from English into Persian using the forward-backward technique, and its content validity was examined by 10 relevant experts. In addition, in order to assess its reliability and internal consistency, Cronbach's Alphas were measured, which were more than 0.7 in all its categories. To analyze the data, descriptive and inferential statistics (t-test, U-Mann Whitney, Kruskal-Wallis, one-way ANOVA, Pearson correlation coefficient, and Poisson regression) were applied using the SPSS19 software. P-values <0.05 were considered to be statistically significant.

Results

Participants' demographic and occupational characteristics have been illustrated in Table 2. All employees of the suppression division worked on a shift work basis, consisting of 24 h of working and subsequently 48 h off work. Furthermore, exercising for an hour per shift was mandatory for all of them.

According to the results, the firemen's work ability was in the good category, demonstrated by the fact that their mean WAI score was 40.86 (SD=5.4). On the whole, 5

Table 2. The participants' occupational and demographic characteristics

Variable		Mean (SD)	Number (%)
Age (year)		33.3 (6.3)	-
Work experience in suppression division (year)		9.8 (6.4)	-
Height (cm)		178.4 (5.5)	-
Weight (kg)		80.9 (9.5)	-
BMI (kg/m^2)		25.41 (2.5)	-
Leisure-time physical exercise hours per week		8.01 (6.08)	-
Smoking habit	Yes	-	56 (15)
	No	-	295 (78.9)
	Quit smoking	-	23 (6.1)
Marital status	Married	-	297 (79.4)
	Single	-	77 (20.6)
Having extra job	Yes	-	130 (34.9)
	No		242 (65.1)
Educational level	GCSE	-	198 (53.4)
	Associate degree	-	95 (25.6)
	Bachelor or above	-	78 (21)
Job position	Station manager	-	18 (4.9)
	Shift commander	-	38 (10.3)
	Commander assistant	-	53 (14.4)
	Senior firefighter	-	70 (19)
	Firefighter	-	190 (51.5)

SD: Standard Deviation BMI: Body Mass Index GCSE: General Certificate of Secondary Education

(1.3%), 63 (17%), 170 (45.4%), and 137 (36.3%) persons belonged to poor, moderate, good, and excellent work ability, respectively.

The analysis of participants' answers showed that about one third of them (31.1%) scored 8 out of 10 to their perceived current work ability compared to the lifetime best. In addition, the majority of the participants (55.9%) scored 4 out of 10 for their ability to meet the physical demands of firefighting, which was exactly the same as the score given by 54.7% of the subjects for their ability to meet the mental demands of their work.

Regarding health status, almost one third of the participants (32.9%) had no diagnosed disease, and a significant number of them (65.3%) mentioned that they had no work impairment due to illness. Moreover, slightly below three quarters of the subjects (73.9%) reported no sick leave during the past year, and a large proportion of them (77.7%) were fairly sure that they could continue their current job for two more years. Likewise, they achieved high scores in terms of psychological resources; in fact, almost 157 in 375 participants (41.9%) obtained the maximum score of this item and exactly the same numbers gained 3 out of 4.

According to Table 3, work ability was higher in firemen who were single ($P<0.01$), without extra jobs ($P<0.05$), and without previous experience of smoking ($P<0.05$) compared to their counterparts. As can be predicted, work ability decreased by age and the highest and the lowest WAI scores were found among fewer than 30 year olds and the 40 plus age group, respectively. There was also a statistically significant difference in scores with respect to job positions. More specifically, in a decreasing order of magnitude, senior firefighters, firefighters, station managers and shift commanders, and finally commander assistants had greater work ability scores, respectively ($P<0.01$). Those firemen whose BMI was normal had significant higher work ability in comparison with the overweight or obese ones. There was not any significant difference in work ability among firemen with different educational levels ($P>0.05$).

Table 4 shows significant negative correlations between WAI and age, BMI, and work experience in the suppression division ($P<0.01$). It denotes that by increasing age, BMI and work experience WAI will decrease. Furthermore, there was a significant positive correlation between WAI and weekly leisure-time physical exercise

Table 3. Examining the relationships between WAI and the participants' occupational and demographic characteristics

Variable		Number (%)	Work ability		P-Value
			Mean	SD	
Marital status	Single	77 (20.6)	42.53	4.5	0.003
	Married	297 (79.4)	40.41	5.5	
Age group (year)	Age≤30	135 (38.14)	42.13	4.6	0.001
	30<age≤35	127 (35.88)	40.72	5.2	
	35<age≤40	53 (14.97)	39.36	5.5	
	Age>40	39 (11.02)	37.95	6.6	
BMI (kg/m^2)	18.5≤BMI<25 (Normal)	168 (47.86)	41.8	5.5	0.004
	25≤BMI<30 (overweight)	168 (47.86)	39.89	5.4	
	BMI≥30 (obese)	15 (4.27)	40.53	5.5	
Having extra job	No	230 (64.61)	41.27	5.2	0.049
	Yes	126 (35.39)	40.09	5.7	
Smoking experience	Yes	75 (20.95)	39.63	5.8	0.027
	No	286 (79.05)	41.18	5.3	
Job position in suppression department	Station manager and shift commander	52 (14.65)	39.42	6.4	0.001
	Commander assistant	52 (14.65)	38.73	5.0	
	Senior firefighter	68 (18.78)	41.85	5.0	
	Firefighter	184 (51.83)	41.6	5.1	
Educational level	GCSE	198 (53.40)	41.13	5.6	0.061
	Associate degree	95 (25.60)	41.40	4.9	
	Bachelor or above	78 (21.00)	39.52	5.5	

SD: Standard Deviation BMI: Body Mass Index GCSE: General Certificate of Secondary Education

Table 4. Correlation between WAI and age, BMI, work experience, leisure physical exercise time per week, and WAI items

Variable	WAI	
	r	P-Value
Age (year)	–0.277	0.001
BMI (Kg/m^2)	–0.187	0.001
Work experience (year)	–0.281	0.001
Leisure physical exercise time per week (hour)	0.206	0.001

BMI: Body Mass Index

hours.

Poisson regression that was applied to detect the effective factors on WAI, showed that age and weekly leisure-time hours of exercise have significant impacts on WAI (Table 5).

More investigations also showed that the overweight and obese firemen were older than those with normal BMI [mean difference (MD): -3.574, 95% Confidence Interval (CI): -4.798--2.350, P<0.01]. In addition, further examination interestingly indicated that single employees were younger (MD: -6.163, 95% CI: -7.253--5.074, P< 0.05), and had a lower BMI (MD: -0.975, 95% CI: -1.61--0.34, P<0.05) in comparison with the married ones. In addition, single participants reported more leisure exercise time per week than married ones (P<0.05) [median (min-max) leisure physical exercise time per week in single participants was 9 (0-50) h, and in married ones was 5 (0-50) h]. Additionally, higher exercise time was reported in non-smokers compared to the smokers [median (min-max) in the leisure-time exercise hours in the first group was 6 (0-50) h and in the second one was 4 (0-14) h].

Discussion

Firefighters are at risk of numerous health challenges

Table 5. Poisson Regression to indicate effective factors on WAI

Variable	Estimation (β)	Exp (β)	SE (β)	P-Value
Age (year)	–0.004	0.996	0.0016	0.017
Leisure physical exercise time per week (hour)	0.003	1.003	0.0014	0.019
BMI (Kg/m^2)	–0.005	0.995	0.0035	0.167
Marital status (singles versus marrieds)	0.012	1.012	0.0226	0.584
Smoking (non-smokers versus smokers)	0.015	1.015	0.0242	0.530

BMI: Body Mass Index SE: Standard Error

and a range of various illnesses; for instance, based on previous studies, musculoskeletal[29], cardiovascular[30], and sleep disorders[31], as well as high perceived psychological stress levels[32] have been predominantly reported among them[33]. Therefore, the importance of periodic assessments of these staff member's health statuses and capabilities in relation to the physical and mental demands of firefighting tasks is undeniable.

In this study a good work ability in Iranian firemen was revealed based on their mean WAI score (40.86±5.4), which was quite similar to the result of an assessment of Belgian firefighters' work ability with figures of 40.6±5.4[34]. Compared to the results of another similar study conducted by Goncalves (2001) on Brazilian firefighters', in every age group, Iranian firemen showed higher scores in WAI. More specifically, the reported mean WAI scores of Brazilian firefighters were 40 at the age of 20-24, 36.04 at the age of 30-34 and 35.24 at the age of 40-44, and in comparison the Iranian firefighters had scores of 42.75, 41.03, and 39.90 in those age groups, respectively[10].

With regard to the relationships between WAI and demographic variables, the results showed that age had a significant negative impact on this ability, which is a finding that was indicated in several previous studies as well[8,10-13]. Moreover, there was a significant negative correlation between work experience and work ability (r=-0.28, p=0.001). It can be justified by the fact that by increasing age and therefore work experience, the body's physiological reserves decline[35] and exposure to hazardous factors at work increases; consequently, a reduction in work ability can be predicted in time[36]. Another positive correlate for higher work ability was exercising, which was also reported in several other studies[14,15,18,19]. There are some possible explanations for this positive impact, including exercise induced improvements in the body's physiological functions[2,37] and reductions in the incidence of chronic diseases and morbidities (the third item in WAI)[18]. The study also showed that normal BMI firemen had statistically significant higher WAI scores compared to the overweight or obese ones; nonetheless, the Poisson regression analysis showed that the effect of BMI on WAI is not significant. One justification for this is that the overweight and obese firemen were older than those with normal BMI. Therefore, although similar to some previous studies where the negative relationship between WAI and BMI was pointed out[12,15,17], the effect of BMI was influenced by age. Another finding was that the single firemen had higher work ability compared to their counterparts. Interestingly, the single employees were younger, and had a lower BMI in comparison with the married ones. In addition, single participants reported more leisure exercise time per week than the married ones (P<0.05).

Work ability was also higher in non-smokers than in smokers. Although smoking has marked negative physiological influences on the body, the Poisson regression analysis showed that smoking did not have a statistically significant impact on WAI. This may be rooted in the higher exercise time in non-smokers compared to the smokers.

Regarding work ability in different job positions of the firemen, significantly decreased scores were seen in the upper levels of hierarchy of job positions. This can be clarified by the rule that in the Tehran Fire Department those who are employed as firefighters, by increasing work experience and gaining job promotion points, can gradually upgrade to the upper levels of senior firefighter, commander assistant, shift commander, and finally station manager. Hence, in the upper levels of hierarchy, either the employees' age or work experience is generally higher than the lower levels; accordingly, their work ability could be different. Interestingly, work ability was higher in those employees who only worked as fireman and did not have extra jobs compared to their counterparts. Therefore, fulfilling workers' financial needs in order to prevent them from attending extra jobs would be important.

The cross-sectional design of the study and therefore the lack of its ability to show effects of different factors with the lapse of time was one of the restrictions of the study. Similarly, applying a subjective tool for assessment of work ability was the other study limitation although high attempts were made to achieve the most accurate participants' answers through clarification of each of the survey questions for them. One of the WAI weakness ar-

eas is the possibility of unawareness of diseases they may have for those who answer it. Also, as the amount of sick leave was considered as a job performance element when promotions were offered to the firemen, it was possible that they came to work even when they needed sick leave. Hence, the reported work ability may be higher than the reality.

Owing to the fact that all the firemen surveyed were shift workers, this study did not have the chance to assess the relationship between work ability and shift working. However, many studies have already shown reduced work abilities in shift workers compared to non-shift workers[11,14]. Similarly, considering the same working hours per month for all the participants, differences in work ability with respect to working hours per month could not be analyzed. In addition, the station managers and shift commanders, beside their supervisory and management tasks, did participate in the field practical activities as well; therefore, the evaluation of their abilities in either practical or managerial tasks separately was not possible.

Numerous studies have shown the impacts of social support on enhancing work ability and job satisfaction, and reducing the amount of mental stress, anxiety, depression, and also frequency of sleep disorders in workers[8,38,39]. Therefore, the impacts of providing social and emotional support to firemen's work ability and job performance would be important to assess in further surveys.

Different studies on firemen confirmed that the scope of firemen's psychological stress level is extensive[38,40]. Additionally, Liu et al. (2001) revealed that job stress can reduce work ability[41]; therefore, providing periodic stress reduction workshops and psychological consultations for firemen in order to familiarize them with psychological tension management strategies could be valuable.

Conclusion

The study indicated that work ability in Iranian firemen was acceptable. However, considering their job nature, which requires their best performance in the emergency situations, identifying the effective factors on their work ability is vitally important. In addition, in order to enhance firemen's efficient performance, all of these factors need to be considered in their pre-employment and periodic health examinations. Age and leisure physical exercise time per week had significant effects on work ability in this study. Therefore, making policies to mitigate the negative impacts of aging on work ability and also providing better workout plans are indispensable. Finally, further evaluation of work ability using concomitant subjective and objective methods and using analytical examination to discover all possible effective factors on firemen's work ability is needed, and also more studies to compare work ability of operating firefighters in suppression field and official employees in Fire Department are recommended.

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